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(54) Title: MAGNETIC SWITCHING OF CHARGE SEPARATION LIFETIMES IN ARTIFICIAL PHOTOSYNTHETIC REACTION CENTERS

(57) Abstract

Excitation of a triad artificial photosynthetic reaction center consisting of a porphyrin (P) covalently linked to a fullerene electron acceptor (C_60^-) and a carotenoid secondary donor (C) leads to the formation of a long-lived $C^+ - P - C_60^-$ charge-separated state via photoinduced electron transfer. This reaction occurs in a frozen organic glass down to at least 8 K. At 77 K, charge recombination of $C^+ - P - C_60^-$ occurs on the μs time scale, and yields solely the carotenoid triplet state. In the presence of a small (20mT) static magnetic field, the lifetime of the charge-separated state is increased by 50 %. This is ascribed to the effect of the magnetic field on interconversion of the singlet and triplet biradicals. At zero field, the initially formed singlet biradical state is in equilibrium with the three triplet biradical sublevels, and all four states have comparable populations. Decay to the carotenoid triplet only occurs from the three triplet sublevels. In the presence of the field, the S and T_0 states are still rapidly interconverting, but the T_+ and T_- states are isolated from the other two due to the electronic Zeeman interaction, and are not significantly populated. Under these conditions, recombination to the triplet occurs only from T_0 , and the lifetime of the charge-separated state increases. This effect can be used as the basis for a magnetically controlled optical or optoelectronic switch (e.g. AND gate).